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OBJECTIVE FRAMEWORKS FOR ECOSYSTEM PROGRAM PLANNING IN THE SOUTHWEST REGION

by

Svein Fougner and George Boehlert

ADMINISTRATIVE REPORT LJ-89-02

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OBJECTIVE FRAMEWORKS FOR ECOSYSTEM PROGRAM PLANNING IN THE SOUTHWEST REGION

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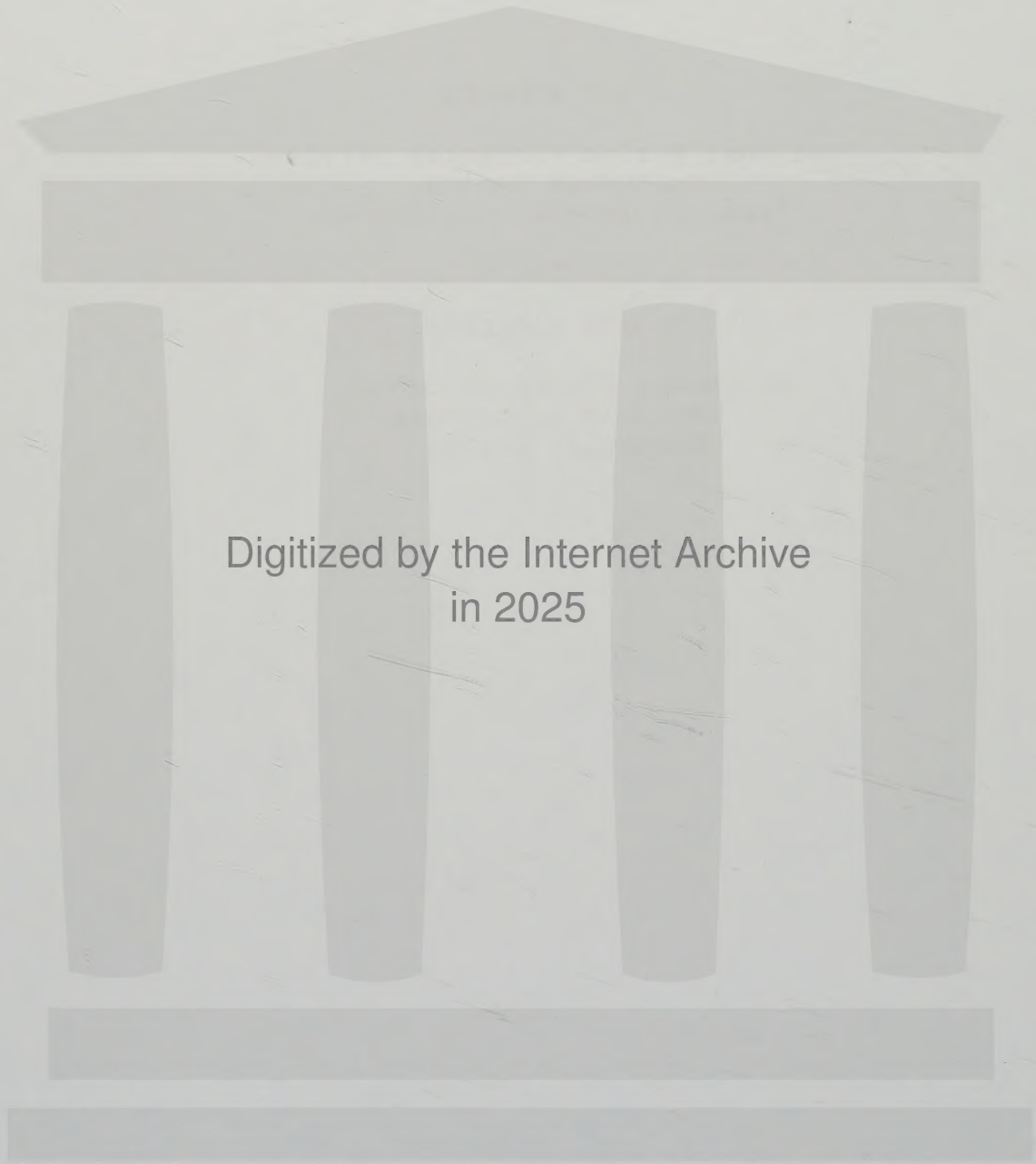
SWFC ADMINISTRATIVE REPORT LJ-89-02



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UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
300 South Ferry Street
Terminal Island, California 90731

October 1, 1987 F/SWR31:SF

MEMORANDUM FOR: F - William E. Evans

FROM: F/SWR - E. C. Fullerton

SUBJECT: Objective Frameworks for Ecosystem Program Planning

Attached are the objective frameworks for the California Current Ecosystem and the Pacific Oceanic Ecosystems, the two Regional Marine Ecosystem (RME) units for which the Southwest Region was assigned lead responsibility. I would like to acknowledge the full cooperation from the Northwest Region and the Northwest Center in preparing the California Current objective framework as well as the excellent contributions from the Southwest Center on both objective frameworks. Region and Center staff put in long hours to complete the documents on schedule.

We expect that there were significant differences in the approaches used by the different Regions and Centers in completing their respective documents. We appreciate the plan of F/MB to circulate copies of the documents along with Office Directors' review comments to all the Regions and Centers so we can consider these differences before our discussions at the Directors meeting.

Several planning issues arose frequently in this exercise:

1. It was not clear whether current budgets and statutory conditions should be taken as constraints in formulating the strategy and scheduling milestones. As a general rule, we did not consider these as constraints since we think the intent at this stage should be to develop a good program rather than a minimal program.

2. We found that some of our current program activities could not easily be integrated into the objective framework in an ecosystem context. Many of our programs and activities must be carried out and milestones must be achieved whether or not the NMFS operates with an ecosystem approach. For example, my SES contract provides that I participate on U.S. delegations at meetings to negotiate regional tuna fisheries agreements and that I provide timely information on SWR programs to constituents. We found it difficult to establish "ecosystem" milestones for such

ongoing activities; we expect other Regions had the same problem. As a general rule, we included most SES and MBO milestones as well as some routine support functions in the objective frameworks.

3. It was difficult to establish firm criteria to maintain a consistent level of detail for milestones throughout both the objective frameworks. The objective frameworks may have more detail than is necessary at this stage. We do not view this as a problem since this means we are that much closer to completion of the PDPs.

We look forward to receiving copies of the objective frameworks from other Regions and the review comments of the Office Directors.

cc: F/SWC - I. Barrett
F/NWR - R. Schmitten
F/NWC - W. Aron
F/SWC2 - R. Shomura
F/SWC3 - N. Abramson

CALIFORNIA CURRENT ECOSYSTEM

III. Objective Statement

To increase our understanding of the California Current ecosystem and the factors that influence the productivity of its living marine resources and to translate that understanding into improved management which provides maximum net benefit to the U.S.

V. A. Ecological Unit Description

The California Current System is one of the world's four major eastern boundary currents and as such is characterized by coastal upwelling. Its surface waters are subarctic in origin and their high nutrient levels are due to a combination of high nutrient source water plus upwelling within the system.

The California Current Ecosystem is essentially an open system with no clearly defined boundaries and few sharp gradients. Even the coast is a shaky boundary as anadromous and estuarine spawning fishes are significant components of the region's fisheries. The northern boundary is best described by the summer position of the west wind drift which occurs near the northern end of Vancouver Island in British Columbia. The southern boundary is in southern Baja California where the California Current converges with equatorial water. The offshore boundary of the California Current is usually given as the offshore extension of the surface salinity minimum which lies at about 700-900 km offshore (435-560 miles). However the exploitable fauna of the California Current system is dominated by neritic organisms which are concentrated closer to the coast. Therefore the offshore boundary of the California Current Ecosystem is taken to be the mean position of the summer wind stress maximum; this places the offshore boundary at about 200 kmk (125 miles) from the continental margin. These boundaries define the California Current Ecosystem as the region of divergence and upwelling and it places the area of convergence and downwelling in the Oceanic Pacific Ecosystem.

Seasonal and interyear environmental variability within the California Current Ecosystem are associated with variations in the North Pacific Basin atmospheric pressure systems which control the local winds and Ekman transport, and with the physical processes related to the transports of the equatorward California Current and the poleward Under Current and Inshore Counter Current. Thus it will be necessary to obtain and analyze information concerning the environmental effects of remote forcing from both equatorial and mid-latitude regions before the variability of the California Current Ecosystem can be understood.

A large proportion of the dominant fishes, birds and marine mammals of the California Current Ecosystem are migratory and this fact makes it undesirable to break the system into subecosystems. There are, however, somewhat distinct habitat zones which can be classified as ecological units: these are the Littoral, the Pelagic, the Demersal, and the Anadromous. The littoral unit comprises the nearshore shallow water habitat and the living marine resources supported by the habitat. Principal species of interest are California halibut, kelp and sand basses, juvenile rockfish, lobsters, crabs, sea urchins, sea otters, and harbor seal. The pelagic unit encompasses the offshore surface layer and its species, including coastal pelagic fish (anchovy, mackerel, herring, bonito, sardine, squid and hake); coastal pinnipeds (harbor seals, sea lions) and cetaceans (harbor porpoise);and seabirds. The demersalunit consists of the benthic habitat and bottom dwelling species,and can be further divided into shelf and slope components. Species of interest in the shelf component include most rockfish, English and petrale sole, lingcod, hake, Pacific halibut and shrimp, as well as elephant seals and sea lions. In the slope unit, the principal species are Dover sole, sablefish and Pacific Ocean perch. The anadromous unit comprises the fish species which are resident in marine waters for much of their life but enter or return to fresh water for their reproductive cycle, the habitat which supports these species, and the non-fish species with which there are interactions. Principal species of interest are Pacific salmon (chinook, coho, chum, pink, and sockeye), steelhead, shad, striped bass, sturgeon, harbor seals, and stellar sea lion. Pacific salmon are uniquely adapted to use different ecosystems at different stages of their life. In completing their life cycle, they move through freshwater, estuarine, coastal and oceanic ecosystems. Although some populations may complete their entire ocean residence within the California Current Ecosystem, others merely transit the zone en route to distant water feeding grounds in the North Pacific off Alaska. In addition, the California Current Ecosystem is a transit or seasonal use zone for certain migratory species such as tunas, billfish, cetaceans and seabirds.

V. C. Ecosystem Program Management and Research Objectives

1. Management

A. Manage and assist in managing California Current Ecosystem fisheries of recreational, commercial or ecological importance to provide a continuing stream of benefits to society.

B. Achieve and maintain optimum population levels of protected species through stock management, fishery management and habitat conservation, and permit commercial and recreational uses of those resources consistent with those population levels.

C. Maintain and where possible increase the stocks of living marine and estuarine resources of recreational, commercial or

ecological importance through conservation and enhancement of the habitat on which they are dependent.

2. Research

A. Establish the range of natural variability in populations of important CCE species in response to environmental and habitat factors, including consideration of functional relationships among predators, prey and competitors.

B. Develop new techniques, including predictive models, for the management of CCE resources.

V. D. Program Strategy

1. Method of Accomplishment

The program strategy is to expand cooperative and coordinated efforts with State agencies, the Pacific Regional Fishery Management Council, academia, and other Federal agencies in designing and carrying out management and research efforts. The results of past efforts will be reviewed to determine the extent to which data and analyses can be used in new modeling efforts. New research and modeling will be undertaken and the results will be incorporated into current and future fishery management plans or amendments and into protected species and habitat conservation programs as the results become available. Data collection programs and data submission requirements will be reviewed and where necessary modified to ensure that complete, accurate and timely fishery data are available on principal fisheries. Biological sampling programs will be reviewed and modified as necessary to achieve comparability of results and usability of the data. Statutory and treaty obligations relative to salmon fishery management will be met in cooperation with States, the Pacific Council, Indian tribes, and special management organizations, and collaborative research with Canada will be undertaken. The NMFS will work with State agencies and other Federal agencies (Corps of Engineers, FERC, Bureau of Reclamation) to carry out Fish and Wildlife Coordination Act and other responsibilities for assuring that habitat productivty is protected from adverse effects of resource decisions by those other agencies. Activities affecting protected species will be controlled to ensure that allowable take levels (if any) are not exceeded, and habitat for such species will be protected. There will be close cooperation with and assistance to states in management of fisheries which are of principal concern to States but have potential implications for management of resources for which there is a Federal interest, especially in an ecosystem context.

2. Management and Research Subobjectives

Management

Assist the States in management of interjurisdictional resources and the restoration and maintenance of associated habitats of the littoral zone with consideration of Marine Mammal Protection Act and Endangered Species Act requirements.

Manage pelagic and demersal resources in association with other resources at Optimum Yield with consideration of Marine Mammal Protection Act and Endangered Species Act requirements throughout the shelf and slope components of the pelagic and demersal zones.

Assist States, Indian tribes, and other organizations in conserving, enhancing and managing Pacific salmon resources throughout their range to achieve annual escapement goals and harvest levels established by the Pacific Council, U.S.-Canada Pacific Salmon Commission, West Coast States, and Indian tribes with fishing rights.

Improve adult and juvenile fish passage at hydroelectric facilities and other barriers through research, monitoring, engineering design review, transportation programs, and coordination of spill programs at water projects.

Research

Establish and implement data collection programs and data submission requirements in cooperation with States to ensure that fisheries data are adequately complete, accurate and timely to monitor fisheries and assess the condition of stocks, to evaluate the effectiveness of management systems, and to contribute to development and refinement of ecosystem models.

Develop and test models to determine the relationships among environmental conditions, habitat productivity, and living marine resources of the California Current Ecosystem, and incorporate test results into resource management programs to the extent practicable.

3. Performance Measures

The effectiveness of the program will be demonstrated by our improved understanding of the ecosystem and will be evaluated by changes in:

- status of stocks under management or protection
- performance of fisheries under management
- achievement of FMP objectives
- habitat suitability for living marine resources
- adequacy of data collection and submission programs
- passage success for anadromous species
- utility of predictive models

V. E. 2. Major Accomplishments/Key Decision Points (Milestones)

A. Anadromous

Complete annual reviews of fishery performance and management effectiveness under Ocean Salmon Fisheries FMP

Complete and submit technical analyses and advice to the Pacific Council and other salmon management organizations annually for management of salmon fisheries

Produce and distribute annual ocean salmon fishery regulations booklet

Implement preseason and inseason regulations under Ocean Salmon Fisheries FMP

Complete annual summary reports for Fraser River Sockeye season

Issue and implement preseason and inseason Fraser River regulations on a timely basis

Complete inputs to annual Fish and Wildlife Program Annual Report for Northwest Power Council

Complete Fall Chinook Hatchery Evaluation Annual Report

Complete Columbia River smolt monitoring report

Complete annual Columbia River detailed fishery operating plan

Complete annual report of Fish Transport Oversight Team

Complete Tributary Adult Passage annual report

Complete Fish Passage Data Information System annual report

Complete transport of salmonid smolts annually

Complete assessments of survival of salmonids at dams

Complete GSI studies of chinook salmon fishery

Develop and evaluate radio-tracking system for juvenile salmonids

Periodically update evaluation of economic value of salmonids for use in mitigation assessments

Complete annual review of Columbia River Power System Operations

Complete annual elements of comprehensive research program to improve production and quality of salmon reared in public hatcheries on the Columbia River and in Puget Sound, develop improved husbandry techniques for salmonids, and develop genetic techniques for identification of stocks of salmonids

Complete annual report on accomplishments in conserving and enhancing anadromous species habitat

Complete annual review of the effectiveness of Sacramento River winter run chinook restoration program and recommend program changes as necessary

Participate on Klamath River Management Council and make recommendations for annual Klamath River chinook management measures to the Pacific Council

Support U.S. Section of Southern Panel of the Pacific Salmon Commission

Complete documentation for settlement agreements for relicensing or Rock Island and Tolt hydropower projects (1988)

Complete documentation for settlement agreements for Skagit and Mid-Columbia hydropower projects (1989)

Petition FERC for full restoration associated with Elwha, White River, and Cushman hydropower projects (1991)

B. Demersal

Provide resource assessment documents and other technical analyses and advice to the Pacific Council for management of West Coast groundfish

Complete annual report on the status of West Coast Groundfish fisheries

Implement annual and inseason changes in management measures to carry out Groundfish FMP

Complete statistically reliable design of standardized coastwide port sampling program for groundfish fisheries of the West Coast (1988)

Expand SWFC groundfish program to include sablefish, whiting and important species of flatfish (1988)

Expand the Tiburon rockfish studies on the effect of environmental changes on groundfish recruitment success and test hypotheses of the relationship between upwelling plumes and the distribution of early life history stages of rockfish (1988)

Complete report on management implications of prey switching in rockfishes and associated species (1988)

Complete pilot egg production biomass surveys for sablefish and Dover sole (1988)

Begin pilot study of the trophic relations in slope

groundfish populations (1988)

Begin study of the contribution of early life history stages of slope groundfish to marine mammals and seabirds (1988)

Complete report on optimum multispecies harvesting strategies for rockfish (1988)

Complete design of program to develop bio-socio-economic model of groundfish fishery (1988)

Implement with the State of California area and gear restrictions in the southern California set net fishery for halibut to reduce the rate of entanglement of grey whales (1988)

Establish a data collection and processing system to record and report information on entanglement of large whales in fishing gear and other debris (1988)

Complete reports on current abundance of harbor porpoise and harbor seals and on the effect of groundfish gill-net fisheries on these species (1988)

Extend Tiburon groundfish recruitment program to entire California coast (1989)

Expand study to determine the contribution of juvenile rockfish to the diet of marine mammals and seabirds along the California coast (1989)

Complete report on the use of predator gut contents to measure the year class strength of rockfishes (1989)

Complete reports of biomass of sablefish and Dover sole estimated from pilot survey programs in 1988 (1989)

Complete laboratory processing of stomach, neuston and plankton samples from biomass surveys (1989)

Begin development of bio-socio-economic groundfish fishery model (1989)

Complete State-wide eelgrass resource survey in California (1989)

Complete and distribute results of Saltonstall-Kennedy project to test bone softening technology (1989)

Implement full scale coastwide port sampling program based on program design in 1989 (1990)

Expand work on contribution of juvenile rockfish to diet of marine mammals and seabirds along California coast (1990)

Complete report on relationship between upwelling plumes and

distribution of early life history stages of rockfish (1990)

Complete report on relationship between oceanographic conditions and reproductive physiology of rockfish (1990)

Design coastwide egg production surveys for stock assessment of slope groundfish (1990)

Begin development of trophic model of slope groundfish (1990)

Complete progress report on development of bio-socio-economic model of groundfish fishery (1990)

Complete report on stock discrimination for harbor porpoise and harbor seals involved in groundfish gillnet fisheries (1990)

Expand Tiburon groundfish recruitment program to entire West Coast (1991)

Complete report on the effects of weather changes on recruitment success of rockfishes (1991)

Complete report on contributions of juvenile rockfish to distribution of marine mammals and sea birds (1991)

Complete bio-socio-economic model of West Coast groundfish fishery (1991)

Conduct coastwide egg production survey for slope groundfish (1991)

Complete report on contribution of early life history stages of slope groundfish to diets of marine mammals and seabirds (1991)

Test the utilization of predictions of recruitment success in management models of groundfish (1992)

Reevaluate the status of coastal marine mammal populations that are impacted by groundfish gillnet fisheries (1992)

Complete report presenting biomass estimates derived from egg production biomass surveys for sablefish and Dover sole (1992)

Complete report on development and use of trophic model for slope groundfish (1992)

Test the application of the bio-socio-economic model for the management of the West Coast groundfish fishery (1992)

C. Pelagic

Complete annual review of northern anchovy fishery for Pacific Council in accordance with FMP requirement

Complete annual status report on coastal pelagic fisheries

Complete estimation of northern anchovy spawning biomass and announce optimum yield and U.S. harvest quotas based on spawning biomass level

Complete market and trade analyses for squid and Pacific mackerel (1988)

Complete environmental assessment for expansion of Northern Anchovy FMP to a Coastal Pelagic Fisheries FMP (1988)

Complete reports of current status of pinniped populations which feed in the coastal pelagic complex (sea lions, elephant seals, harbor seals) and determine the information needed to assess carrying capacity for these protected species (1989)

Complete a field experiment using new techniques to determine the environmental factors affecting the recruitment of Pacific sardine and/or northern anchovy (1990)

Complete report on changes in food habits of California sea lions and relate these to changes in pelagic fish availability, environmental conditions, and marine mammal population size (1990)

Complete and test a multispecies, environment dependent model of the major pelagic fishes of the California Current Ecosystem (1991)

Reevaluate the status of coastal marine mammal populations that feed in the coastal pelagic complex relative to current and historic carrying capacity of the habitat (1992)

D. Littoral

Conduct annual workshops of Region and Center fishery and wildlife biologists and other agencies' specialists to identify research needed to determine the status and productivity of habitat components in the littoral zone and to discuss research priorities

Complete annual coastal/estuarine habitat accomplishments report

Complete periodic reports of the fate and effects of chemical contaminants (organic chemicals, fossil fuels, combustion products, metals) on estuarine and coastal species

Complete report on results of research into marine species dependence on coastal wetlands and estuaries (1988)

Complete Statewide eelgrass resource survey in California (1989)

Complete study of the habitat value of transplanted eelgrass at selected sites in California (1989)

E. Multi-unit

Complete annual review of the adequacy of fishery data collection and submission programs and recommend changes as necessary to generate adequately complete, accurate and timely data for fishery monitoring, stock assessments, and ecosystem modeling

Complete annually scheduled tasks to carry out SWR/SWC/CFG Marine Recreational Fisheries Strategic Plan

Approve annual Saltonstall-Kennedy funding priorities

Complete statistical design of program to monitor impacts of fishing and non-fishing activities on marine mammals and seabirds (1988)

Establish and enforce allowable take limits for fisheries which take sea lions, elephant seals, harbor seals, or harbor porpoise (1988)

Complete environmental assessment for issuance and enforcement of general permits to allow incidental take of marine mammals at levels specified in the permits for 1989-1994 (1988)

Complete documentation of fisheries data collection protocols and data standards for programs contributing to the Pacific Fishery Information network (1988)

Publish results of selected Saltonstall-Kennedy projects from 1984-1986 (1988)

Complete reviews of FMPs to determine measures needed to incorporate new information regarding habitat and forage requirements of protected species which are affected by fisheries (1989)

Monitor incidental take of marine mammals in commercial fisheries relative to quotas specified in general permits and implement management measures as necessary (1989)

Complete five-year status reviews for species listed as threatened or endangered and propose reclassifications and delistings as appropriate (1989)

Establish a formal habitat mitigation policy to address living marine, estuarine and anadromous resource habitat requirements throughout the California Current Ecosystem and develop area-specific mitigation guidelines for application in habitat conservation programs with other agencies (1989)

Complete study of habitat values and productivity of

transplanted eelgrass habitat (1990)

Complete review of the "unit stock" concept and its application to marine mammal and fish populations in the California coastal community (1991)

PACIFIC OCEANIC ECOSYSTEMS

The Pacific Oceanic Ecosystems encompass the broadest geographic range and ecological diversity of any of the Regional Marine Ecosystems (RMEs) under consideration by NMFS. In a north-south direction, the geographic boundaries of this RME extend to the outer margins of the North and South Pacific Transition Zones, which are arbitrarily defined as 45`N and 45`S, respectively. The eastern boundary of the ecosystem is the continental margin of the Americas, excluding coastal waters and the California Current and Gulf of Alaska RMEs. To the west, continental margins similarly bound this RME in the North Pacific, but in the South Pacific, the boundary extends to include the Indo-Pacific Islands that separate the Pacific and Indian Oceans.

The criteria used to subdivide this RME into subecosystems are based first upon biogeographic provinces and second upon habitat and species types. Inserted in this RME is a classification category above the subecosystem level, namely Insular and Pelagic. Although there is significant interaction between insular and pelagic ecosystems, separate ecosystem models will be necessary to describe them and to provide management advice in each.

Insular ecosystems are characterized by resources that logically divide into shelf and slope assemblages. The shelf assemblage typically includes lobster, reef fishes, neritic pelagics, and certain other crustaceans. Interactions of protected species (including monk seals, sea turtles, coastal dolphins, and some whales) with man, fisheries, and other ecosystem components occur most frequently in the insular shelf region. The slope assemblage includes bottom fishes, deep sea shrimps, and precious corals. Four subecosystems defined for the Insular category are the Hawaiian Archipelago, the Indo-Pacific Islands, the Islands of Oceania, and the Subtropical-Temperate Seamounts.

Pelagic ecosystems may be characterized by water masses, as is frequently the case for plankton communities. Pelagic resources and protected species of concern, however, often migrate through different water masses. In tropical regions, tunas such as yellowfin, bigeye, skipjack, and billfish are of greatest importance. In the more temperate regions near the transition zones, albacore are important. Pelagic subecosystems have thus been defined as the Eastern Tropical Pacific, the Central and Western Tropical Pacific, the North Pacific Transition Zone, and the South Pacific Transition Zone. Each subecosystem will be described separately below.

PACIFIC OCEANIC ECOSYSTEMS

III. Objective Statement

To understand the Pacific Oceanic Ecosystems and the factors that influence the productivity of their living marine resources and to translate that understanding into improved management that provides for the conservation and optimum use of those resources.

V. A. Subecosystem: Hawaiian Islands

The Hawaiian Archipelago is a 1,500 nautical mile chain of high islands, atolls, and seamounts--all of volcanic origin. The archipelago lies on a northwest-southeast axis with the Island of Hawaii (19`N lat., 155` W long.) at its southeastern tip. The bathymetry of the islands, atolls, and shallow seamounts is characterized by a gently sloping shelf extending from shore to about 100 m, then a steep slope to at least 950 m. Limited, but ecologically important estuarine systems exist on the high islands.

Fisheries resources associated with the shelf system, specifically reef fishes, lobsters, and neritic pelagics are moderately to heavily fished. The deep slope resources include bottom fishes, which are primarily composed of a multispecies snapper group, deep sea shrimps, and precious corals. Currently, only the bottom fishes are heavily fished, but the shrimps, precious corals, and possibly other crustaceans exist in sufficient abundance for commercial harvest. Fishery management plans have been developed for lobsters, bottom fishes, and precious corals.

Protected species in the Hawaiian Archipelago are monk seals, sea turtles, dolphins, and humpback whales. Significant interactions, primarily in the shelf system, occur between these protected species and fisheries resources and gear.

V. C. Subecosystem program objective

Manage stocks of insular species, including marine mammals and endangered species, and conserve habitat productivity to achieve optimum benefits.

V. D. Program strategy

1. Method of Accomplishment

The program strategy in the Hawaiian Archipelago is to continue concentrating on exploited insular resources (bottomfish, slipper and spiny lobster, deep-sea shrimp), marine mammals and endangered species (Hawaiian monk seal, sea turtles), and the habitat supporting these living marine resources. Each year, the program will incorporate more research and monitoring in

environment, habitat, and non-commercial but associated ecosystem components. We will concentrate our efforts to develop new ecosystem approaches in the Hawaiian Archipelago, as opposed to the other Insular subecosystems because of our greater knowledge of the ecosystem and physical environment, and the greater availability of fisheries data. By developing models here, we will be able to later apply them at lower effort to other island areas. Results of research and modeling and relevant data from fishery monitoring programs will be incorporated into fishery management and protected species and habitat conservation programs as the results become available. Management and research programs will be modified as necessary to ensure that data collection and submission requirements generate sufficiently accurate, complete, and timely data for research, management, and modeling.

2. Management and Research Objectives

Management

Manage and assist in managing Hawaiian fisheries of recreational, commercial or ecological importance to provide a continuing stream of benefits to society.

Achieve and maintain optimum population levels of protected species through stock management, fishery management, and habitat conservation and permit commercial and recreational uses of marine resources consistent with those population levels.

Maintainand where possible increase the stocks ofliving marine and estuarine resources of commercial, recreational and ecological importance through conservation and enhancement of the habitat on which they are dependent.

Research

Establish range of natural variability in populations of important insular species in response to environmental and habitat factors; include considerations of functional relationships among their prey, predators, and competitors.

Develop new techniques, including predictive models, for the management of insular ecosystems and their important species.

3. Performance Measures

The effectiveness of the program will be demonstrated by our improved understanding of the ecosystem and will be evaluated in terms of changes in:

- status of stocks under management or protection
- performance of fisheries under management

- achievement of FMP objectives
- habitat suitability for living marine resources
- adequacy of data collection and submission programs
- utility of predictive models

V. E. 2. Major Accomplishments/Key Decision Points (Milestones)

Complete annual reports presenting data on fishery conditions, status of stocks, status of habitat, and other information needed to assess the effectiveness of management programs.

Complete annual review of fishery data collection and submission programs and implement changes to generate needed data for fishery management, research, and ecosystem modeling.

Conduct annual workshop of SWC and SWR fishery and wildlife biologists and other agency specialists to identify habitat conservation issues and discuss habitat research priorities.

1988

Implement limited entry amendment to Bottomfish FMP.

Implement escape gap and other measures in Amendment 5 to Crustaceans FMP.

Implement amendment 1 to Precious Corals FMP to increase exploratory area quotas.

Complete and approve State-Federal Marine Recreational Fisheries Strategic Plan.

Issue report on the variability in mean size and biomass of adult baitfish populations in Pearl Harbor, Oahu.

Complete manuscript on time series of data on seabird feeding in the Northwestern Hawaiian Islands.

Publish manuscript on horizontal distribution of larval fishes around Johnston Island.

Publish user manual for habitat inventory/mapping system.

Develop model for incorporating age-specific variation in length into the annual assessment of bottom fish.

Issue report on population size trends in the Hawaiian monk seal.

Complete manuscript on artificial reefs as stocking and management tools.

Demonstrate "headstart" project's ability to increase numbers of monk seal births at Kure Atoll.

Develop and apply forecasting model for multispecies lobster fishery.

Complete manuscript on longline timer assessment technique and its application to fisheries research.

Approve and distribute Recovery Plan for Hawaiian sea turtles.

Assess the construction impacts and recovery rate of a climax coral reef ecosystem from a coastal construction project carried out at Keahole Point, Kona, Hawaii (report annually thru 1990).

Establish habitat mitigation policy and modify as appropriate to incorporate results of research into factors affecting habitat productivity.

1989

Complete a report describing the fluctuations of baitfish stock abundance in response to physical factors, prey, and predators.

Issue report on habitat depth utilization by Hawaiian monk seals.

Complete manuscript on vertical distribution of ichthyoplankton around Oahu.

Define marine and terrestrial habitat utilization by hawksbill turtles.

Issue report examining an 18-year series of reef-fish transect counts to determine whether any species shows cyclical interactions with other species or associations with available meteorological and oceanographic data.

Examine the vertical distribution of the Southeast Hancock Seamount fish community (within and among species) and its diurnal, seasonal, and annual variability.

Provide an estimate of potential yield of deep sea shrimp and other deep sea crustaceans to promote the efficient development of these fisheries if stocks are commerciall viable.

Issue report on management recommendations for baitfish populations of estuarine/inshore areas.

Develop and apply novel age determination methodology to

insular stocks.

Refine and apply forecasting model for multispecies lobster fishery and provide management advice.

Develop an integrated market monitoring program for Hawaiian commercial (insular and pelagic) fisheries.

Develop an economic model of commercial fishery interactions in the Northwestern Hawaiian Islands.

Implement elements of humback whale recovery plan pertaining to Hawaii.

1990

Design and begin surveys to determine stock size and status of cetacean populations that interact with Hawaii fisheries.

Determine the habitat requirements of north Pacific humback whales during the winter breeding season in Hawaii.

Complete a report on the mitigation aspects of a series of artificial reefs, designed and constructed specifically to enhance recruitment of juvenile reef fish.

Issue report on life history, including vital rates and trophic dynamics, for Hawaiian monk seals.

Complete report examining a 2-year time series of nehu egg production estimates for two habitats to determine synchrony between populations and relationship to environmental factors.

Publish report on incidence, impact, and cause of fibropapilloma (tumors) in Hawaiian green sea turtles.

Define stock relationships, recruitment ranges, and dispersal capabilities of endemic insular species.

Refine and apply forecasting model for multispecies lobster fishery and provide management advice.

Publish report on energetics and estimated maximum population size of Hawaiian monk seals.

Convene international workshop on fishery forecasting.

Issue report evaluating chemical treatment of captive male Hawaiian monk seals.

Review marine recreational fisheries data collection program and initiate changes as necessary to improve amount, accuracy or

timeliness of data.

Convene workshop on economic modeling of commercial fisheries interactions in the Northwestern Hawaiian Islands.

Complete status review of Hawaiian monk seal.

1991

Determine importance of high island estuarine productivity to the health of insular shelf ecosystems.

Publish paper on the effects of ocean currents interacting with islands on larval fish distributions and resultant recruitment.

Determine whether vertically structured hydrodynamic processes are responsible for larval retention of lobster resources in the Northwestern Hawaiian Islands.

Identify pre-recruit habitats (including pelagic, inshore, and demersal) for important species in tropical insular systems.

Publish report evaluating the Kure headstart and rehabilitation programs for Hawaiian monk seals.

Refine and apply forecasting model for multispecies lobster fishery and provide management advice.

Issue report on population size of insular cetaceans including humpback whales.

Develop model to estimate energy flux between pelagic and insular ecosystems.

Revise the ECOPATH ecosystem model to incorporate new approaches to ecosystem modeling.

Incorporate pre-recruit survey data into lobster forecast model.

Evaluate potential for a multi-fishery FMP for the northwestern Hawaiian Islands.

1992

Develop ecosystem model concentrating on protected species with specific inputs for human interaction.

Publish document evaluating treatment and removal of male seals from the Laysan Island population.

Publish model of seamount ecosystem as applied to Southeast

Hancock Seamount.

Submit recommendation to reopen seamount groundfish fishery or extend moratorium to promote rebuilding.

Define stock relationships, recruitment ranges, and dispersal capabilities of selected pan-Pacific insular species.

Determine variability in year-class strength of bottom fish through cohort analysis.

Apply remote sensing methods to insular fisheries research.

Publish results of stock assessments by habitat type for Hawaiian green sea turtle populations.

Refine and apply forecasting model for multispecies lobster fishery and provide management advice.

PACIFIC OCEANIC ECOSYSTEMS

III. Objective Statement

To understand the Pacific Oceanic Ecosystems and the factors that influence the productivity of their living marine resources and to translate that understanding into improved management that provides for the conservation and optimum use of those resources.

V. A. Subecosystem: Indo-Pacific Islands

On the western edge of the Pacific are a number of large islands and archipelagos, including Indonesia, Papua New Guinea, and the Philippines. The marine ecosystems at these islands are similar to their oceanic counterparts but have greater species diversity and a closer linkage to Southeast Asian environmental regimes, including monsoon effects. The large islands have increased shelf areas, and estuarine and mangrove habitats are more important than in the smaller oceanic islands.

V. C. Subecosystem program objective

As requested, provide assistance in matters pertaining to fisheries, habitat, and protected species.

V. D. Program strategy

At the present time, the NMFS has no specific research interests or management programs in the Indo-Pacific Islands subecosystem. Our present strategy is to continue to maintain or improve our relationships with the fisheries officers there and provide advice as requested. Requests for assistance from the island governments are handled on a case-by-case basis and typically include providing advice on data collection, sampling strategy, sample processing, and limited requests for training. Requests to provide significant assistance, such as the South Pacific Resource Assessment Initiative (which also pertains to many nations of the Islands of Oceania subecosystem), are processed through the U.S. government and require additional funds. Although interesting ecological comparisons between this and other Insular subecosystems may be developed in the future, at the present time there will be no scientific program objectives or milestones.

V. E. 2. Major accomplishments/ key decision points

No management or science objectives or milestones necessary.

PACIFIC OCEANIC ECOSYSTEMS

III. Objective Statement

To understand the Pacific Oceanic Ecosystems and the factors that influence the productivity of their living marine resources and to translate that understanding into improved management that provides for the conservation and optimum use of those resources.

V. A. Subecosystem: Islands of Oceania

The Islands of Oceania range from single island countries such as Nuie Island to large archipelagos such as the Kingdom of Tonga and Fiji. This subecosystem includes the islands of Guam, the Commonwealth of the Northern Mariana Islands, and American Samoa. In a general context, the marine ecosystems of all these islands are similar to that described for the Hawaiian Islands. Numerous differences occur in specific species occupying the same niche, however, because of endemism and differences in habitat and environment; this is true both in comparing islands within this subecosystem and in comparing those from the Hawaiian Archipelago subecosystem. The bottom fish, reef fish, neretic pelagic fish, and crustacean resources are moderately exploited in some of these islands, whereas only the reef fishes are harvested at other islands. Because of the relatively small size of most of the islands and their associated reef and slope/shelf areas, there is a significant interface with the surrounding oceanic pelagic subecosystems.

V. C. Subecosystem program objectives

1) Guam, CNMI, American Samoa

Manage stocks of insular species, including marine mammals and endangered species, and conserve habitat productivity to achieve optimum benefits.

2) Other Island Areas

As requested, provide assistance in matters pertaining to fisheries, habitat, and protected species.

V. D. Program strategy

1. Method of accomplishment

In determining the research strategy for this subecosystem, we first subdivide it into categories, based upon political association with the United States, which determines the responsibilities of the NMFS. First, the Northern Marianas,

Guam, and American Samoa have closer ties with the United States than do the other Islands of Oceania. We thus have greater responsibility to carry out and assist in living marine resources management, data collection and analysis, and research in these areas. The program strategy in these areas will be based upon the same management and research objectives as for the Hawaiian Archipelago, but fewer activities and milestones, particularly those related to ecosystem management objectives, will be considered over the next 5 years. The major activities will be associated with monitoring fisheries and completing annual fishery reviews for fisheries under management; conserving protected species and their habitat; and to the extent practicable, extension of research and modeling results from Hawaii to the Marianas Archipelago and American Samoa. Greater effort will be expended should exploitation rates rise sufficiently to suggest adverse impacts on insular resources. It is anticipated also that close ties will be maintained with the Federated States of Micronesia, the Marshall Islands, and the Republic of Palau, to which assistance and advice will be given as requested.

2. Management and Research Objectives

A. American Samoa, Guam, and CNMI

Management

Manage and assist in managing fisheries of recreational, commercial or ecological importance to provide a continuing stream of benefits to society.

Achieve and maintain optimum population levels of important species through stock management, fishery management, and habitat conservation and permit commercial and recrational uses of marine resources consistent with those population levels.

Maintain and where possible increase the stocks of living marine and estuarine resources of commercial, recreational and ecological importance through conservation and enhancement of the habitat on which they are dependent.

Research

Establish range of natural variability in populations of important insular species in response to environmental and habitat factors; include considerations of functional relationships among their prey, predators, and competitors.

Develop new techniques, including predictive models, for the management of insular ecosystems and important species therein.

B. Other Island Areas

Assist in design and implementation of fishery information systems and data collection/analysis programs to support living marine resource management and research.

3. Performance Measures

The effectiveness of the program will be demonstrated by our improved understanding of the subecosystem and will be measured in terms of changes in:

- status of stocks under management or protection
- performance of fisheries under management
- achievement of FMP objectives
- habitat suitability for living marine resources
- adequacy of data collection and submission programs
- utility of predictive models

V. E. 2. Milestones

A. American Samoa, Guam and CNMI

Annual

Issue annual WPACFIN report on landings from insular and pelagic fisheries.

Complete annual review of data collection and data submission programs and adopt changes to generate needed data for fishery monitoring, research and ecosystem modeling

1989

Complete plan to identify important sea turtle habitat and define conservation measures necessary to provide for the growth of the populations to optimum levels in Guam, CNMI, American Samoa, and other U.S. Pacific possessions.

1990

Publish report on traditional usage of marine turtles and its relation to sea turtle population impacts in American Samoa.

Conduct workshop to assist island fisheries officers in data analysis and sampling design.

1991

Publish manual for data collection/compilation and automation as applied to small island fisheries offices.

Develop economic models of American Samoa, Guam, and CNMI commercial fisheries.

1992

Define stock relationships, recruitment ranges, and dispersal capabilities of selected pan-Pacific insular species.

Complete an economic study of recreational and subsistence fisheries economics in the western Pacific region.

Publish report on traditional usage of marine turtles and its relation to sea turtle population impacts in Guam and the Northern Marianas.

B. Other Islands

1990

Conduct workshop to assist island fishery officers in design of data collection, sampling, and analysis programs.

1991

Publish and distribute manual for data collection/compilation and automation for small island fishery agencies

1992

Collaborate on an international forum on the techniques appropriate for economic analysis of Pacific island fisheries.

PACIFIC OCEANIC ECOSYSTEMS

III. Objective Statement

To understand the Pacific Oceanic Ecosystems and the factors that influence the productivity of their living marine resources and to translate that understanding into improved management that provides for the conservation and optimum use of those resources.

V. A. Subecosystem: Subtropical-Temperate Seamounts

In the higher latitudes of the Pacific Oceanic Ecosystems, islands are relatively rare compared to tropical regions, but seamounts of varying summit depth occur in abundance; many seamounts are in international waters. There is a greater range of environmental variability, both seasonal and interannual, as the subtropical and subarctic fronts vary in latitudinal position. The fauna changes from tropical to temperate and includes many seasonal migrants. Deeper seamounts of the central North Pacific (between 29˚ and 30˚N lat.) have supported highly productive fisheries, but stocks have been depleted. Assessment and management of such international or transboundary stocks will require international cooperation.

V. C. Subecosystem program objective

Assess status of stocks and encourage international management for transboundary or international stocks of insular species.

V. D. Program strategy

1. Method of accomplishment

The principal resource in this subecosystem of interest to the U.S. at this time is the seamount groundfish complex, principally pelagic armorhead and to a lesser extent alfonsin and dory. The research strategy will be directed toward understanding the dynamics of the overall range of the pelagic armorhead and eventually moving to management issues. The majority of the armorhead population is in international waters, and most research and modeling of the seamount complex will be carried out in the EEZ around Hawaii (see Hawaiian Archipelago Subecosystem program objectives and milestones). Those results will be extrapolated to the full extent of the temperate seamounts as appropriate. Efforts also will be expended to develop international cooperation in research and data exchange with the goal of international management of the seamount resources should it prove to be feasible.

2. Research and Management Objective

Monitor recovery of armorhead population in central North Pacific seamounts and promote international cooperation in management.

3. Performance measures

Progress in meeting the objective will be demonstrated by:

- improved data exchange with foreign interests knowledgeable about or concerned with seamount resources
- utility of Hawaiian seamount modeling in assessing temperate seamount stock responses to environmental changes

V. E. 2. Major Accomplishments/Key Decision Points

1988

Publish paper on pelagic biogeography of armorhead.

Publish manuscript on age and growth of armorhead.

1990

Report on status of stocks of the pelagic armorhead on central North Pacific Seamounts.

Model of armorhead population fluctuations to examine whether the abundances on different seamounts fluctuate with sufficient synchrony to be considered a single unified stock.

Publish paper on economic status of international seamount fisheries.

1991

Convene international workshop on North Pacific seamount resource management.

Model recruitment variability in pelagic armorhead stocks as a function of fishing and oceanographic variability.

1992

Complete report comparing the variation in the abundance of armorhead to that of other North Pacific Gyre epipelagic fishes (salmon) to determine whether armorhead fluctuations could be due to ocean-wide environmental events.

PACIFIC OCEANIC ECOSYSTEMS

Eastern Tropical Pacific

III. Objective Statement

To understand the Pacific Oceanic Ecosystems and the factors that influence the productivity of their living marine resources and to translate that understanding into improved management that provides for the conservation and optimum use of those resources.

V. A. Sub-ecosystem: Eastern Tropical Pacific

The area and biota of this sub-ecosystem are those of the McGowan Eastern Tropical Pacific province. It covers a roughly triangular area extending from the tip of Baja California to about the border between Peru and Chile with the apex extending westward to 180 in the extreme. Tunas, billfishes, cetaceans, sea turtles, and sea birds make up a community of apex predators whose productivity, abundance, and distribution are driven by their interactions with each other, the dynamics of forage populations, and by natural and human-caused perturbations in the biotic and abiotic habitat of each species.

The productivity of this ecosystem is a result of the interaction of the eastern boundary and equatorial current systems and of coastal upwelling, which collectively provide one of the richest tropical pelagic fishing grounds on earth. Inter-annual climatic fluctuations, such as El Nino occurrences, as well as political and economic forces have a profound impact on the production and distribution of the region's fisheries and on the status of its living marine resources.

Principal species of interest to the U.S. in this ecosystem are the tuna, dolphin and bird populations, all of which are highly mobile within the ecosystem. In addition, the ETP is the source of several species of billfish and other pelagic fish which migrate into the California Current Ecosystem and are of commercial and recreational importance to U.S. fisheries.

V. C. Sub-ecosystem program objectives

Achieve optimum population levels of protected species within the requirements of MMPA and ESA while permitting appropriate levels of commercial and recreational fisheries.

Support domestic and international management to provide a continuing supply of pelagic resources to American fishermen by maintaining stocks.

Provide information regarding ecological relationships among fish and protected species and their environment for management considerations.

V. D. Program strategy

1. Method of Accomplishment

The ETP program objectives will be pursued through domestic management efforts, monitoring of fisheries, resource surveys to assess the status of stocks, and performing experiments to demonstrate the interrelationships among components of the subecosystem. Environmental data collected by other NOAA agencies will be incorporated into models which will be tested to determine their usefulness in forecasting the effects of environmental changes on resource production and availability. Work will continue with the U.S. tuna industry to ensure that the incidental take of marine mammals in the purse seine fishery remains within annual limits, and the U.S. will work with other nations to promote reduced mortality in their tuna fisheries. International agreements will be pursued to achieve optimum harvests from ETP tuna stocks throughout their range, with continued U.S. access to those stocks, and to promote cooperative data collection and analysis for stock assessments.

2. Management and Research Objectives

The following objectives and milestones are focused by necessity to include work required to meet current mandates assigned NMFS and the SWFC regarding yield forecasts for ETP tunas and control of the incidental mortality of dolphins. In addition, data collection and research efforts may be adapted to contribute to a greater understanding of the quantitative relationships and processes controlling the species complexes and trophic levels.

Management

Achieve conservation of tuna and other migratory species in the ETP.

Assure continued access to ETP tuna stocks by U.S. fishermen and availability of foreign-caught ETP tuna to U.S. processors.

Ensure that incidental mortality of marine mammals does not exceed allowable take and does not adversely affect marine mammal stocks.

Achieve increased conservation of marine mammals taken in foreign tuna fisheries.

Promote equitable access to ETP-origin pelagic species for

recreational and commercial fisheries when stocks are in the EEZ.

Research

Determine trends in relative abundance, population condition, and reproductive potential of dolphin populations incidently taken by the tuna purse-seine fishery in the eastern Tropical Pacific Ocean.

Develop yield forecasts for tuna stocks through the establishment and maintenance of high-quality fishery data bases.

Develop and test models to predict spatial and temporal distribution and availability of tropical tunas in relation to oceanographic conditions.

3. Performance Measures

The effectiveness of the program will be demonstrated by our improved understanding of the subecosystem and will be evalusted in terms of changes in:

- status of stocks under management or protection
- harvest and processing of ETP tuna by U.S. industry
- mortality and mortality rates of marine mammals
- adequacy of data collection and data exchange programs
- utility of predictive models

V. E. 2. Major Accomplishments/Key Decision Points (Milestones)

Annual

Conduct monitoring surveys to collect data for estimating trends in abundance of dolphin populations affected by the fishery (thru 1991).

Collect, archive, and curate marine mammal tissues and life history data for long term studies of population condition and age structure and their relationships to changing environmental and fishery conditions (thru 1991).

Produce annual reports summarizing results of dolphin monitoring surveys (thru 1991).

Conduct monitoring surveys of oceanographic factors simultaneously with surveys for estimating trends in abundance, to evaluate the influences of various enk48Hn
observed distributions and abundances of dolp
others (thru 1991).

Produce annual reports summarizing results of oceanographic monitoring (thru 1991).

Submit manuscripts (min 1/yr) to peer-reviewed journals, analyzing results of "dolphin ecosystem" studies (thru 1991).

Report total marine mammal mortality related to U.S. purse seine tuna fishing in the ETP (thru 1992).

Implement tuna/porpoise observer deployment plan.

Complete annual review of foreign performance in marine mammal protection for tuna import certification program.

Complete annual tuna trade analysis report.

Monitor and assess billfish and shark stocks exploited by commercial and recreational fisheries to determine the impact of fishing on the stocks and associated species.

Conduct annual review of billfish recreational fisheries.

Complete review of information on tropical tuna fisheries and the effects of fishing on stocks and associated species.

Produce annual review of fisheries and stocks for IATTC commissioners.

1988

Modify data collection routines, if necessary, of both the ETP research vessels and the tuna-porpoise observers to increase coverage of non-targeted, but trophically critical, species and to collect food habit information when feasible.

Publish papers on oxygen levels limiting distributions and movements of skipjack and yellowfin tunas.

Construct simulation model of tuna purse-seiner fishing process in the eastern tropical Pacific Ocean, with the objective of comparing estimates of dolphin abundance derived from line-transect data collected by scientific observers placed aboard a subset of the tuna vessels with various types of (known) underlying distributions and abundances of tuna and dolphin stocks (TOPS: Tuna-vessel Observer Program Simulator).

Produce report evaluating measures of CPUE derived from tuna-vessel observer data as potential indexes of dolphin abundance.

Publish a techniques report on the use of aerial photography to calibrate school size estimates.

Develop hypotheses about life history parameters expected to change if marine mammal stocks decrease. Prepare experimental

design that includes sample sizes, level of precision, and power.

Use information collected by tuna vessel observers to examine clinal pattern of the eastern and whitebelly stock division.

Prepare manuscript on the use of mtDNA to estimate genetic distance among and within species, populations, and schools of spinner and spotted dolphins.

Prepare manuscript detailing the relationship of serum calcium to the etiology and treatment of post-stress mortalities like those experienced by encircled dolphins.

Implement U.S. regulations governing import of ETP-origin yellowfin taken by non-U.S. purse seine vessels.

Complete assessment of lighting systems required for U.S. purse seine vessels fishing on porpoise in sundown sets and modify U.S. regulations if necessary.

Recommend observer sampling design to improve mortality estimates based on SWC analysis of data from 100% observer coverage program in 1987.

1989

Initiate development of a stochastic and age-structured model of genetic diversity in order to ascertain its utility in estimating exchange rates between so-called stocks and in estimating changes in relative population size.

Publish results of aerial photographic calibration of school size estimates by research vessel observers.

Develop models of the density-compensatory responses in ETP dolphin stocks.

1990

Publish models of the density-compensatory responses in ETP dolphin stocks in support of definitions of optimum population levels and replacement rates.

Summarize results of tuna fishery simulation modelling study in relation to 1) efficacy of tuna vessel observer data for indexing trends in abundance of dolphin populations, and 2) efficacy of model type as useful approach to defining and understanding the processes controlling fishery dynamics.

Initiate food habit analyses of apex marine mammal predators.

Initiate studies to measure genetic diversity of exploited

marine mammal populations to examine exchange rates between populations and relative population sizes.

1991

Develop and test models to predict movement patterns and gear vulnerability of tropical tunas in relation to relevant limiting oceanographic patterns and circulatory patterns.

Develop interactive model between billfish, sharks, and other species relative to environmental effects.

III. Objective Statement

To understand the Pacific Oceanic Ecosystems and the factors that influence the productivity of their living marine resources and to translate that understanding into improved management that provides for the conservation and optimum use of those resources.

V. A. Subecosystem: Central and Western Tropical Pacific Pelagic

The area and biota of this subecosystem are are those of McGowan's Equatorial province and his North and South Central Pacific provinces. Hence, the area extends from the boundaries of the California Current Ecosystem and the Eastern Tropical Pacific Subecosystem to the western boundary of the Pelagic Oceanic subecosystems and between the North and South Transition subecosystems. Many of the biota qualify as warm water cosmopolites and are common to the Eastern Tropical Pacific province and occur seasonally in the North and South Transition provinces. The tunas, billfishes and other pelagic management unit species, marine mammals, sea turtles, and sea birds make up a community of mostly apex predators whose productivity, abundance, and distribution are driven by their interactions with each other, the dynamics of forage populations, and by natural and human-caused perturbations in the habitat of each species.

Variation in productivity and production within this subecosystem is affected by seasonal changes in heating and wind stress, water mass circulation and current patterns, upwelling and vertical mixing, and species movement. The population structure, turnover rate, seasonal distribution, and movement of these large pelagics across the biotic provinces are of great concern, as is the role of near-island habitats and current/frontal systems in aggregating these species.

The most important fisheries are surface and subsurface fisheries for tuna, billfishes and other pelagic management unit species. Understanding the dynamics of forage stocks as they are affected by the abiotic and biotic environment is also essential in modeling the ecosystem. Likewise, the production of baitfish and birds may be important in modeling some fisheries. Near-island habitats are important in the reproduction of many, otherwise pelagic, species. Fisheries data are more comprehensive than the more sparsely and contagiously distributed biological observations and serve as the best source of ecological information in the region.

Many of the fisheries and management jurisdictions in the region are island-based and share fisheries resources with

distant-water fisheries. Political and economic forces have a strong impact on the production and distribution of these fisheries. The mobility of the stocks and the largest fisheries means that to promote the conservation of these resources, NMFS must encourage international cooperation in fisheries monitoring and management.

V. C. Subecosystem program objectives

Achieve optimum population levels of protected species within the requirements of the MMPA and ESA while permitting appropriate levels of commercial and recreational fisheries.

Support domestic and international research and management to provide a continuing supply of pelagic resources to American fishermen by maintaining viable ecosystems.

V. D. Program strategy

1. Method of Accomplishment

The CWTP objectives will be achieved through international cooperation in fisheries research and data collection to facilitate fisheries monitoring and the assessment of the status and yields of the stocks in relation to fishing pressure, environmental fluctuations and changes or degradations in habitat features. Availability of such information will result in the ability to forecast changes in yield. Information on the origins, movements, and turnover rates the large pelagic species needed to make rational assessment of these heterogeneous populations will come from biological sampling and from tracking and tagging studies. Environmental monitoring will rely heavily on remote sensing and national archives of oceanographic data as well as direct observation. Results of research and modeling efforts and relevant data from monitoring activities will be incorporated into the Western Pacific Council's FMP for Billfish and Associated Pelagic Species as the results become available. Management and research programs will be modified as necessary to ensure that data collection and submission requirements generate sufficiently accurate, complete, and timely data for research, management and modeling. The U.S. will actively participate in South Pacific tuna management in accordance with treaty obligations.

2. Management and Research Objectives

Management

Manage and assist in managing CWTP fisheries of recreational, commercial or ecological importance to provide a continuing stream of benefits to society.

Achieve and maintain optimum population levels of protected species through stock management, fishery management, and habitat conservation and permit commercial and recreational uses of marine resources consistent with those population levels.

Assure continued access for U.S. industry to ETP origin tuna.

Carry out U.S. obligations under South Pacific tuna treaty.

Research

Monitor and assess the status of pelagic stocks, and develop yield forecasts through the development of high-quality fishery data bases and environmental time series.

Model the role of distinct habitats within the pelagic ecosystem (islands, current boundaries) with respect to the yield, reproduction, stock heterogeneity, movement dynamics and formation of fishable concentrations of pelagic species.

Model economic and social impacts of natural ecosystem dynamics and the impact of economic forces on the fishery components of the ecosystem.

Develop and implement fishery data collection and submission programs to generate accurate, complete, and timely data for management, research and modeling efforts.

3. Performance Measures

The effectiveness of the program will be demonstrated by our improved understanding of the subecosystem and will be evaluated in terms of changes in:

- status of stocks under management or protection
- performance of fisheries under managements
- achievement of FMP objectives
- adequacy of data collection and submission programs
- utility of predictive models

V. E. 2. Major Accomplishments/Key Decision Points (Milestones)

Annual

Produce annual reports on the status of Hawaii's tuna, billfish and other pelagic management unit species and the fisheries and markets for those species.

Review adequacy of fishery data base and recommend changes in data collection or data submission requirements under FMP to ensure that accurate, complete and timely data will be available.

Provide U.S. tuna fishery data to international participants under South Pacific tuna treaty.

Complete annual report on western Pacific fishery development.

1988

Publish a report on the annual skipjack tuna forecast including the size-specific time-series of the skipjack tuna catch around Hawaii and the environmental factors which influence catch rate.

Report on effectiveness of alternative sampling gear for assessing distribution of the larvae and juveniles of pelagic management unit species and their forage by depth strata for use in the study of recruitment and habitat utilization.

Publish papers on oxygen levels limiting distribution and movements of skipjack and yellowfin tunas.

Publish papers on short term horizontal and vertical movements of skipjack and yellowfin tunas with associated fish aggregating devices.

Issue report describing research objectives, strategies and timetable for defining habitat structure, habitat usage and behavior of pelagic species around Hawaiian Islands (i.e., 5-yr plan).

Approve process for licensing, data collection and observer program for U.S. participation under South Pacific Tuna Treaty.

Complete assessment of Saltonstall-Kennedy projects for western Pacific fishery infrastructure design and construction.

1989

Publish a technical memorandum on a five-year plan for cooperative federal, state, and industry research on the movements, distribution, turnover rate, and origins of ahi (yellowfin and bigeye tunas) around Hawaii and the importance of the insular subecosystem to their life history and ecology.

Report on techniques involving ultrasonic telemetry developed to measure physiological responses of free swimming pelagics to habitat variables.

Complete a seafood market survey in Hawaii as basis for market-monitoring extrapolations.

Report on the analysis of market data and samples obtained from Hawaii landings of mahimahi and wahoo to characterize size

composition, estimate population parameters, and determine stock heterogeneity.

Develop integrated shoreside and market monitoring program for Hawaii's commercial fisheries.

1990

Issue a preliminary report on the relationship between the vertical and horizontal distribution of larvae and juveniles of pelagic management unit species and biotic and physical oceanographic features at the interface between the pelagic and insular ecosystems.

Combine ultrasonic telemetry data involving depth sensitive and physiological transmitters to develop and publish model defining pelagic species' habitat around the Hawaiian Islands.

Produce a forecast of catch rates and species composition for Hawaii's yellowfin tuna fishery based on environmental factors and size specific time-series of catch rates.

Develop endogenous economic models of Hawaii longline and aku (skipjack tuna) fleets and markets.

1991

Develop and test models to predict movement patterns and gear vulnerability of tropical pelagics in relation to relevant limiting oceanographic conditions and circulatory patterns.

Collaborate in local workshop on economic assessment of habitat preservation.

Develop model of western Pacific (Hawaii, American Samoa, Guam, and Northern Marianas) export seafood markets.

Complete report assessing potential for import substitution or export of domestically caught CWTP fishery products.

1992

Complete five-year review of the effectiveness of the FMP for Billfish and Associated Pelagic species as called for by the FMP.

Convene workshop in Hawaii on the inclusion of socioeconomic aspects of commercial, subsistence, and recreational fisheries in ecosystem modeling.

Publish a report on the movements of yellowfin tuna around Hawaii based on tag and recapture studies, time series analysis of size specific catch rates by area, and evidence of stock

heterogeneity.

Issue report on near-term forecasting models for selected pelagic management unit species in the Hawaii fishery based on environmental factors and size specific time-series of catch rates.

PACIFIC OCEANIC ECOSYSTEMS

III. Objective Statement

To understand the Pacific Oceanic Ecosystems and the factors that influence the productivity of their living marine resources and to translate that understanding into improved management that provides for the conservation and optimum use of those resources.

V. A. Subecosystem: North Pacific Transition Zone

The North Pacific Transition Zone (NPTZ) subecosystem is primarily defined by waters of the Kuroshio Current, the Kuroshio Extension and the North Pacific Current. Major oceanographic discontinuities include the northern frontal zones between these waters of subtropical origin and the cold waters of the Oyashio and Subartic Currents, mesoscale features such as eddies and warm core rings spawned by the Kuroshio, and zones of high productivity associated with upwelling in the California Current Ecosystem on the eastern boundary of the NPTZ.

The assemblage of fishes includes some tropical pelagic species, species confined primarily to the NPTZ and some species normally found in subarctic waters. Major fisheries of interest to the United States include the 50,000 t/year Japanese and North American fisheries for albacore, and the 200,000 t/year Japanese, Korean, and Taiwanese drift gill-net fisheries for flying squid. The latter fishery is of particular interest because of its bycatch of albacore, salmon, pomfret, and other fish and the incidental mortality it inflicts on seabirds and marine mammals (e.g., northern fur seal and Dall's porpoise). The squid drift-net fishery and much of the albacore fishery is executed in the transition zone waters between the Subtropical and Subarctic Fronts--hence, the subecosystem name. Besides the fishery interaction problems, the major issues in the zone include impacts of marine debris. Knowledge of physical oceanographic processes in the NPTZ is important for modeling resource distribution, predicting driftnet fleet dynamics and assessing marine debris impacts.

V. C. Subecosystem program objectives

Support international management to maintain stocks at optimum levels and provide for a continuing supply of pelagic resources to American fishermen.

Achieve optimum population levels of protected species within the requirements of the MMPA and ESA while permitting appropriate levels of commercial and recreational fisheries.

Reduce incidental mortality of fish, marine mammals, birds and sea turtles caused by fishing and marine debris.

V. D. Program strategy

1. Method of Accomplishment

The strategy in the NPTZ emphasizes international cooperation. Data bases are shared with other nations with interests in the fisheries and the major problems of net entanglement and marine debris affecting non-target fish and protected species. Joint research is conducted, research vessel surveys are collaborative where possible, and information is provided to assist industry in achieving production goals from NPTZ stocks. Within NMFS, the marine debris and drift gill-net monitoring and research is done jointly by NWAFC and SWFC laboratories and the Marine Mammal Laboratory. Predictive models of stock dynamics and bycatch and entanglement impacts depend heavily on research surveys, monitoring of commercial fishing vessel activity and obtaining and analyzing information on environmental processes. Data for the latter require extensive shipboard sampling and satellite remote sensing. The information from these research activities is used in international negotiations and agreements to assure conservation of protected species taken incidentally in fishing activities.

2. Management and Research Objectives

Management

Achieve and maintain optimum population levels of protected species through domestic and international efforts at stock management and fishing management.

Increase U.S. harvest of NPTZ albacore.

Decrease incidental take of U.S.-origin salmonids in foreign net fisheries.

Research

Develop and test models to predict the average spatial and temporal distribution and relative abundance of major NPTZ species of finfish, squid, seabirds and marine mammals, taking into account their multispecies ecological linkages and the effects of oceanographic conditions.

Estimate the magnitude and composition of the by-catch and entanglement of finfish, seabirds, marine mammals and sea turtles in the North Pacific driftnet fisheries, assess their impacts, and develop mitigating measures.

Determine the nature, sources, distribution, abundance and persistence of marine debris, assess its impact on populations of fishes, seabirds, marine mammals and sea turtles, and develop mitigating measures.

Develop and maintain systems of data collection, data base management, oceanographic research, biological analysis and numerical modeling necessary to assess the North Pacific albacore stock, monitor the fisheries, and allow evaluation of harvest policy options.

3. Performance Measures

The effectiveness of the program will be demonstrated by our improved understanding of the subecosystem and will be evaluated in terms of changes in:

- status of stocks under management or protection
- performance of U.S. fisheries
- incidental take of protected species
- foreign take of U.S.-origin salmonids
- utility of predictive models

V. E. 2. Milestones

Annual

Complete annual report from marine debris surveys in the northwestern Hawaiian Islands.

Complete annual report on the status of the north Pacific albacore fishery.

Complete annual report with initial estimates of by-catch and entanglement in squid drift gillnet fisheries and with recommendations for improved data collection.

Complete annual report on debris sightings and samples from collaborative research cruises.

1988

Report on FY 87 collaborative research vessel surveys.

Report on NMFS-hosted international workshop to review biological and oceanographic data and establish strategies for cooperative research on squid gill-net bycatch and entanglement problems (Honolulu workshop, April 88).

Develop and implement program to recruit, train and place observers aboard commercial squid gill-net vessels.

Report on first-cut estimates of by-catch and entanglement in squid drift gill nets, and recommendations for improving the estimates.

Report on satellite tracking experiments to study movements of derelict drifting gill nets.

Report on analysis of Japan/U.S. albacore tagging data to estimate migration parameters, exploitation rates and fishery interactions.

Report on development and evaluation of oceanographic forcing functions for models of albacore stock and fishery dynamics.

Compile and distribute updated North Pacific albacore data base.

1989

Convene SWC albacore workshop to assess status of stock, exchange fishery data and review research progress.

1990

Complete reports on impacts of marine debris on populations of sea birds, sea turtles, Hawaiian monk seals and other endangered or threatened species.

Test improved model of albacore stock structure and age composition.

1991

Report on models of average distribution of squid, albacore, salmon, sea birds and marine mammals in relation to oceanographic features.

Complete reports for biannual albacore workshop (Japan).

Complete and test model to predict timing and magnitude of eastward migration of 3- and 4-yr old albacore based on dynamics of Kuroshio and other environmental factors.

1992

Evaluate estimation procedures to estimate magnitude and composition of by-catch and entanglement.

Report on model to predict distribution dynamics of marine debris based on ocean circulation and current systems, fishing fleet activity and other factors.

Report on model to predict distribution dynamics of marine debris based on ocean circulation and current systems, fishing fleet activity and other factors.

Test improved model of albacore stock and fishery dynamics, incorporating effects of environmental processes on distribution, availability and catchability.

Evaluate impact of drift gill-net fisheries on albacore stock and yield to other fisheries, using new simulation model and data bases.

Evaluate models to forecast species distributions in relation to oceanographic conditions.

III. Objective Statement

To understand the Pacific Oceanic Ecosystems and the factors that influence the productivity of their living marine resources and to translate that understanding into improved management that provides for the conservation and optimum use of those resources.

V. A. Subecosystem: South Pacific Transition Zone

The South Pacific Transition Zone (SPTZ) subecosystem is defined primarily by the subtropical waters between about lat. 20°S and the southern boundary of the subtropical convergence zone, the latter being the region of mixing between the southern subtropical and subantarctic water masses. The major oceaonographic discontinuities in the SPTZ are associated with boundary currents off Australia and South America, current and bathymetric features near New Zealand, and by frontal features of the convergence zone.

The fish fauna includes substantial stocks of squid, pomfret, slender tuna, and albacore. The albacore resource is the target of an established 35,000 t/year Asian longline fishery, and a new and rapidly growing U.S. troll fishery in the convergence zone. In addition to such direct fishery interactions, there are significant indirect fishery interactions acting through ecological linkages. Of particular interest in the latter area is the 2.4 million t/year multinational fishery off South America for Peruvian jack mackerel, which, in its juvenile stages, is the dominant forage of albacore in the convergence zone. As in the NPTZ, data on intraseasonal and interannual variability of the convergence zone waters is important for modeling resource productivity, distribution and availability, and for evaluating potential fishery interactions.

V. C. Subecosystem program objectives

Support international management to maintain stocks at optimum levels and provide for a continuing supply of pelagic resources to American fishermen.

Achieve optimum population levels of protected species within the requirements of the MMPA and ESA while permitting appropriate levels of commercial and recreational fisheries.

V. D. Program strategy

1. Method of Accomplishment

The SPTZ objectives will be achieved through a balanced

program of fishery data base development, fishery monitoring, stock assessment, oceanographic surveys, biological sampling and numerical analysis. Consistent with established practice, the NMFS research program will be integrated with those of collaborating foreign research agencies and coordinated with the U.S. fishing industry. The joint strategy is efficient, and assures that the best information will be available for U.S. fishery development and policy analysis in the area. Because resources for shipboard oceanographic surveys and experiments are limited and the region is large, maximum use will be made of remotely sensed environmental data to model dynamics of the subtropical convergence zone where the major fisheries occur.

2. Management and Research Objectives

Management

Increase U.S. industry participation in SPTZ fisheries.

Achieve and maintain optimum levels of important species through domestic and international measures to prevent or minimize adverse effects from fisheries or other activities.

Research

As a first step to predictive models of South Pacific albacore population dynamics, develop preliminary models of age, growth, distribution and migration, taking into account effects of oceanographic processes.

Develop and test models to predict the potential surface yield of South Pacific albacore and impacts of surface fisheries on the longline fishery.

Develop the economic data base and models required to evaluate alternative operating strategies for U.S. trollers targeting albacore in the North and South Pacific, and for identifying investment risks and strategies for new entrants to the fishery (e.g., South Pacific Islanders).

Develop and maintain the systems of data collection, data base management, modeling and numerical analysis necessary to monitor the South Pacific albacore stock and fisheries, and to allow evaluation of harvest policy options.

3. Performance Measures

The effectiveness of the program will be demonstrated by our improved understanding of the subecosystem and will be evaluated in terms of changes in:

- status of stocks under management of protection
- performance of U.S. fisheries
- adequacy of data collection and management systems
- utility of predictive models

V. E. 2. Milestones

Annual

Complete annual report on south Pacific albacore fishery.

Complete annual assessment of the status of south Pacific albacore stock.

Complete annual report on cooperative albacore tagging program.

1988

Submit report on cooperative tagging experiments through the 1987 fishing season.

Compile and distribute inventory of historical oceanographic data on thermohaline structure of subtropical convergence zone, based on shipboard observations and satellite remote sensing.

Report on first-cut estimates of surface fishery yield potential and identify data requirements and research strategy for assessing fishery interactions.

Establish and implement cooperative agreement with U.S. albacore industry to collect economic data required for model of fleet operating strategies, and prepare report of preliminary model.

Compile and distribute comprehensive inventory of south Pacific albacore data, resolve differences among data sources, and establish protocols for port sampling and vessel logbooks (cooperative workshop in August 88).

1989

Complete report on experimental designs and tagging strategies for modeling albacore migration and stock structure.

1990

Publish paper on interannual variability of subtropical convergence zone oceanography.

1991

Complete analysis of aging validation methods and report on first-cut age and growth model.

1992

Report on improved models for yield forecasting and analysis of fishery interactions.

Complete age-structured model of albacore stock dynamics.